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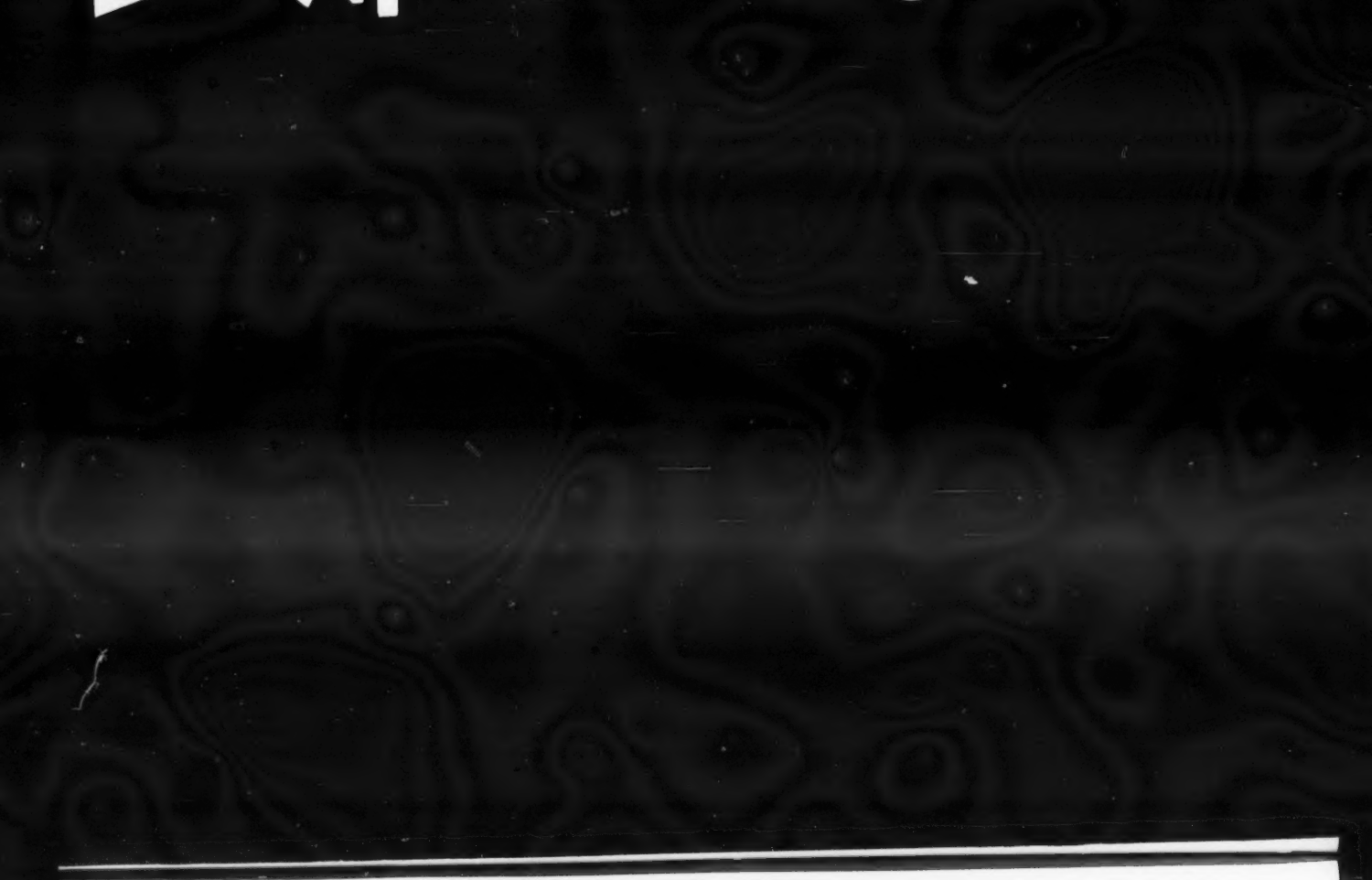

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PETER ZODAC

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The Official Journal of the Rocks and Minerals Association

(Courtesy U. S. National Museum)

EMERALD
Stony Point, Alexander Co.
North Carolina. Natural size.
Weight 9 ounces.

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WHOLE NO. 75

RENO CLUB OBSERVES ANNUAL FIELD TRIP

By FRED G. GREULICH

Twenty-nine members of the Reno Rocks and Minerals Study Club observed their annual field outing on Sunday, June 6 by traveling in seven motor cars to Oreana, Pershing County, Nevada, to visit and inspect the Tungsten and Dumortierite deposits found in that section of the state.

The day was ideal and the club members had a very interesting trip. Besides the two main objectives the caravan party had the pleasure of realizing several others. In addition to visiting the Tungsten mine in Oreana Canyon and inspecting the rare Dumortierite deposits in Humbolt Queen Canyon, near by, the party experienced the thrill of traveling for more than fifty miles over the old Lake Lahontan bottom, viewed the Rye Patch Dam, and inspected the underground tunnel workings of the tungsten properties.

Leaving Reno about eight o'clock in the morning they drove east to Lovelock, stopped at Dad Lee's place a short distance beyond the town, took refreshments and then resumed the journey to Oreana Canyon.

On the outward journey the caravan traveled over highways which were built on the bottom of one of the world's largest extinct lakes—Lake Lahontan. This lake, which geologists declare existed between 1,500 and 20,000 years ago, in its days normally was about 400 miles long by over 200 miles wide. Evidences of its ancient short line were visible on the hillsides all the way to Lovelock. At one place as many as 20 distinct shore lines were noted. These shore lines were plainly marked and indicated the various levels of the old lake waters before it finally dried up and disappeared. The benches were still sharply indented on the brown colored hills and appeared on either side of the roadway. Many flat areas were also crossed which showed the grayish-white alkaline deposits left when the great fresh water body became dessicated. These patches of white exist in considerable numbers and in places they were made conspicuous by the typical desert "dust devils."

June days are good days for dust devils. In many places the white dust was sucked up from the loose dirt and whirled into the sky by the prevailing winds. Moving forward in a rotating motion, at a rapid speed, some of these swirls extended from the ground upward for nearly a hundred feet, moving forward in all directions. Sometimes they held the equilibrium for almost five minutes before dissipating. But just as quickly as one subsided others would rise in different places to rivert the attention of the caravan members enroute to their first objective.

At Dad Lee's Place, a unique spot on the Nevada desert, a short distance east of Lovelock, and about 100 miles east of Reno, the party became interested in the collection of antiques and desert

relics, reminiscent of the pioneer days of Nevada. In addition to many hundreds of ore specimens, some of which are rich in gold and silver, Dad Lee has also made an effort to reproduce in realistic fashion some of the characteristic conditions as they existed during the Goldfield rush days as well as other notable events in Nevada's history. Scattered here and there are small tents with attached cards bearing such euphonious but notorious names as "Klondike Kate's", "Rattlesnake Petes" and many others. The first pool table, so the placard says, ever used in Nevada, the first pair of crap dice, an old saddle owned by a former notorious outlaw of the desert, high wheeled ore wagsons, of the type so commonly used during the Comstock Days and before the automobile truck made its appearance on the highways, and other objects of a similar nature were assembled here at this strange Humbolt river valley spot. Another item of particular interest to tourists who stop there to replenish supplies while crossing the last stretch of the Humbolt Valley is a generous supply of desert painted glass. Glass of certain kinds, as is well known, will turn violet in color in a few years if exposed to the full force of the desert sun.

After leaving Dad Lee's place several members of the party digressed from the scheduled route and turned northwest a few miles to view the Rye Patch Dam. This dam was built across the Humbolt in 1935, for the purpose of impounding, for irrigating purposes, the Spring run-off waters, and later supplied to ranchers in the Lovelock district.

The entire party again reassembled a short distance east of Dad Lee's place and began the short but rather steep climb by motor car from highway U S 40 into Oreana Canyon, on the northern flank of the Humbolt range of mountains. The Canyon cuts back into the range and lies about five miles from the highway. A fairly good dirt road leads directly to the workings, of the Oreana canyon tungsten mine. Here the Nevada Massachusetts Company, which operate other large tungsten deposits at Mill City, in the same general region,

Some members of the Reno Club who attended the annual field trip. Pres. Walter Palmer, 2nd from right; Sec.-Treas., Mrs. Rader L. Thompson, 4th from right.

and at Silver Dyke, Nevada, has developed a tungsten deposit which promises to become a very important unit in their production volume.

Three years ago two prospectors named Marker and Gordon were working in these Humbolt mountains, in Oreana canyon, looking for gold. They didn't find gold but found something almost as valuable. They found tungsten, only they didn't know it at the time. They discovered a peculiar formation on the hill side, examined it carefully, and concluded it carried values of some kind. They sent specimens of the rock to the State Analytical Laboratory, at the Mackay School of Mines in Reno, for analysis and assay. Prof. Walter S. Palmer, Director of the laboratory, and Prof. Wm. I. Smyth his assistant, both members of the Rocks and Minerals Study Club, put the specimens through all the tests and determined the fact that the rock contained a high percentage of tungsten, and also contained some beryl. Upon receiving their assay returns, the prospectors staked claims and began development work. But the character of the formations called for large scale operations which the two prospectors were not equipped to handle; so they sold their claims to the Nevada Massachusetts Company who took over the Oreana Canyon property and began intensive development. Within thirty days the company had mined and milled ore with value more than sufficient to pay the entire cost of the original claims.

This company installed machinery and began driving tunnels, also sinking on the vein. Results proved beyond expectations and the program of development was enlarged. At the present time besides the vein stopings which descend nearly a hundred feet, several tunnels have been driven into the ore vein.

Members of the Rocks and Minerals Study Club were privileged to enter one of these tunnels and view the method of operation. Club members reached the site shortly before noon at which time dynamite blasts were to be fired underground. Consequently they decided to take lunch while the blasts

Tungsten Mine in Oreana Canyon near Oreana, Nevada. Photo shows ore bin and intrusive granodiorite patch in left center. Tool house at right.

were discharged and then wait a sufficient time to permit the tunnel to clear of gas. Results of the blasting were then to be observed.

After lunch the party scrambled up the hill to the tunnel portal, some climbing the waste dump pile, others taking the easier trail up and around the power house to gain the 75 foot elevation. Before entering the tunnel, however, the party inspected the ore bins, and nearly every member, upon invitation of the superintendent, secured a sample or two of the tungsten ore found in the bins.

With the superintendent of the mine leading the way the party walked over the tram tracks, single file, and entered the tunnel, where the cool air was a distinct relief from the warm outer atmosphere. A short distance in, the tunnel became darkened and members were holding to each other to keep in line and avoid stumbling over the tram rails, or running blindly into the walls. The superintendent with his carbide lamp lighted the way for the members in the lead of the party.

About 100 feet in from the portal we reached the place where blasting occurred. While the gas was still strong, it was not in quantities enough to produce any ill effects, and club members scarcely noticed the gas because of their eagerness to see what had occurred in the tunnel. With the flickering carbide lamps the miner led the way through the narrow and winding tunnel to see the spot where the powder had been exploded. In the damp, dark and cool tunnel everything looked black except where the carbide lamp cast a weird light on the walls or was reflected in the face of leaders of the grotesque procession.

Our curiosity about the results was soon satisfied however. The spots where the powder had broken down the rocks in the vein were pointed out, but the light reflected from the carbide lamp made no distinction in the kinds of rock. They all looked black and were dripping slightly with water.

Soon however there occurred an amazing transition. The mine superintendent had brought with him a portable fluorscope connected with batteries. All over the walls and ceilings the light was moved and quickly detected the scheelite constitutent in the rocks. Scheelite fluoresces a light purplish color, or a yellow whitish one according to mine location. Members of the club who up to this time had been fearfully silent, began exclaiming with "ahs" and "ohs" at the transition which the fluorscope had produced. The fluorscope is an an invaluable instrument in prospecting for tungsten, and is used by this company in all its workings.

The tungsten deposits at Oreana Canyon are found in contact veins. One wall of the country rock is bluish limestone, metamorphosed, while the other wall is a diorite. The limestone of the region has been intruded by an immense granodiorite dike. At the contact between the dike and the limestone the tungsten ore is found.

After a brief lecture by Prof. Wm. I. Smyth concerning the geology and the ore depositing formation in this region the party moved on to the Dumortierite mine, in Humbolt Queen canyon.

Humbolt Queen canyon lies about four miles farther west in the same Humbolt range and at about the same elevation. Dumortierite is a rare and valuable mineral. At least its finding in commercial quantities is a rarity. In this Nevada canyon there is a very important deposit of Dumortierite, of such a pure quality it is commercially very valuable.

The Champion Sillimanite Co., manufacturers of spark plugs for automobiles, controls and owns this deposit.

Dumortierite is known to occur in four places in Nevada but the Humbolt Queen canyon deposit is the only one of commercial importance.

In 1925 R. H. Roland discovered this deposit and subsequently sold it to the Champion Porcelain Co., of Detroit, Mich., subsidiary of the Champion Spark Plug Co., and the highest grade

dumortierite has been shipped to the company's plant at Detroit and used in the manufacture of spark plugs.

No very good crystals of dumortierite have been found. Practically all the crystal forms of the mineral have been determined by Schaller, whose work is based on six incomplete prismatic specimens. Dumortierite is orthorombic in form. Schaller detected several other forms but the faces were too minute to determine with certainty. Dumortierite crystals are often vertically striated on the prism faces due to repeated pseudohexagonal twinning according to the laws obeyed by cordierite and aragonite.

The most frequent color is some kind of blue variously described as cobalt, azure, ultramarine, lilac, or sodalite blue. Weathered surfaces of this blue variety are often nearly black. Nevada dumortierite also often displays lavender and rose colors. When heated for a few seconds above 800 degrees C the mineral becomes permanently greyish or white.

Dumortierite has a light tint of the color, nearly white, for its streak, is vitreous in lustre, transparent to translucent on thin edges or in crystals, but the massive material appears to be opaque. The structure shows fan-shaped radiating masses, fibrous, acicular, prismatic, crystals, occurring in masses, in spherulite aggregates and as inclusions, while it fractures at right angles to the axis, and has a hardness of seven, a specific gravity of average 3.30, varying somewhat in this respect in the purity of the material.

Very tough in massive aggregates, dumortierite on being heated decomposes to mullite which fuses at 1810 degrees C.

Its value as a porcelain spark plug material lies in the fact that it offers great resistance to heat and internal stresses.

While dumortierite is a rare mineral yet it has been found practically the world over associated with granites, pegmatite dikes, high temperature quartz veins, and contact metamorphic deposits, according to the late Prof. J. C. Jones of the University of Nevada, who gave the mineral much thought and study. With the discovery that an addition of dumortierite with other porcelain making materials, makes an unusu-

Dumortierite Mine in Humboldt Queen Canyon, Pershing County, Nevada. Ore outcrops appear in background.

ally tough and valuable porcelain, the search for such deposits has been stimulated. It is essential, aside from a sufficient quantity and accessibility, that a deposit be practically free from quartz and other associated minerals though such minerals as andalusite and muscovite can be tolerated in considerable amounts, and because it possesses these required characteristics the dumortierite deposit in Humbolt Queen canyon has been found very suitable. The deposits occur at the head of the canyon at approximately 5,500 ft. above sea level and 1000 feet above the valley of the level of the U. S. highway No. 40.

The dumortierite occurs in two parallel zones striking east of north and dipping west. The western zone is marked by a bold outcrop of massive quartz several hundred feet long and fifty feet wide. Little development work has been done on this outcrop as yet.

The eastern zone is about 600 feet east from the western zone and continues up a northern branch of the canyon. This zone is 75 ft. wide and has furnished the bulk of the dumortierite obtained up to the present time. The greater part of the production has come from boulders and lenses found in and near the saddle of the canyon.

Considerable development work at the property has taken place and in spite of the fact that the mine was temporarily shut down at the time of the visit of the club members, the deposit is under control of the Champion company and is being worked from time to time as need requires.

After spending several hours at the mine, inspecting the vein system, and examining the ore already mined and piled in the bins, the party left with specimens and headed for home.

Inspection of the dumortierite mine was supplemented by a brief talk from Prof. Walter S. Palmer, which gave the members a clearer understanding of the value and uses of this rare mineral deposit.

RARE FOSSIL RECEIVED AT FIELD MUSEUM

An excellent specimen of a rare fossil —the trunk or stem of a cycad plant that grew in the Black Hills of South Dakota in the Cretaceous period (about 120,000,000 years ago)—has just been received at Field Museum of Natural History. It is representative of the extinct flora which prevailed at the time when giant dinosaurs roamed the earth, and early birds, then recently evolved from reptiles, were taking to the air.

The cycad, although only two feet in height and sixteen inches in diameter, weighs some 500 pounds in its petrified form. It has the shape of an old-fashioned straw beehive. Its exterior consists of the remains of old leaf bases among which are imbedded numerous large and well developed flower buds. The structure of the fossilized flowers of these cycads has been thoroughly investigated by paleobotanists, and so much is now known about them that a reconstruction at Field Museum of an entire plant may be possible.

These long extinct plants were the precursors of the modern cycads frequently called "sago palms," a misnomer, according to Dr. B. E. Dahlgren, chief curator of botany. Like the modern cycads, the fossils indicate that the ancient ones were seed-bearing woody plants, with leaves leathery in texture and often feathery in form like modern cycad leaves.

The modern cycads constitute a small group of plants of which species occur in Mexico, Central America, Polynesia, South Africa, Australia, and other tropical and subtropical regions. One or two small species are native to Florida, where their underground stems are used for making starch.

The fossil cycad at Field Museum was received from the University of Iowa, which possesses a number of specimens collected before the area in which they were found was designated as a national monument.

AN OPINION OF A MINING ENGINEER 86 YEARS AGO

By RALPH J. MAGRI, Jr.

Gold, the first metal known to man, has been and probably will be, the topic of many discussions. You can pick up practically any current magazine on Science and find the present day opinions and theories on this metal, its monetary value, its commercial value but most of all, in a mineralogical sense, its occurrence. We all know that the gold fields of South Africa yield the world's largest supply, that the purchase of Alaska was probably the wisest investment our country made, due to the gold produced there and that the state of California leads our country in production. The gold rush of '49 opened the resources of that state but before that our largest internal supply came from North Carolina. Virginia also produced some of the metal but these localities were practically forgotten after the West Coast discovery. Well, perhaps one Mining Engineer, Frederick Overman, had occasion to remember them. Why? Because in 1851, two years after the gold rush, Mr. Overman wrote and published a book entitled "Practical Mineralogy, Mining and Assaying", Copyrighted March 1, 1851 and published by Lindsay and Blakiston, Philadelphia. The paragraphs of interest I am quoting below. Mr. Overman is speaking of the occurrence of Gold:

> "It may be wondered why I did not put this article at the head of my list, because it is certainly, at the present time, the most valuable mineral in the United States, representing a greater value than all others combined. As an excuse, I must confess that I have no confidence either in the profitableness of the mines in California or in their permanency."—page 46

> "There are gold bearing localities in Virginia and North Carolina, which, if not equal to those of California at present, will be of greater importance in the future and, I predict, more sure and lasting."—page 47

That is the opinion of a Mining Engineer 86 years ago. You can see his opinion was destined to be wrong although there is no doubt but that Mr. Overman could afford to be skeptical as this book of his was published only two years after the Gold Rush and aren't we all afraid of something new? But to see how far wrong he was, let us get down to figures compare the production of California with that of Virginia and North Carolina. All figures are in fine ounces.

Comparing the figures of 1935, California mined approximately 315,000 times as much gold as Virginia and North Carolina combined and, as you can easily see, is increasing its production each year. But we all make mistakes.

Year California	North Carolina	Virginia
1931—523,135.09	Up to date yield	1828 to 1935, incl.,
1932—569,166.99	has amounted to	total yield was
1933—613,578.85	about $30,000,000	160,944.53
1934—719,063.92		Less than 1,858 in
		the last 28 years
1935—888,510.00	1935—2,175.57	1935—652.52

THE CRATERS OF THE MOON, IDAHO

By PRISCILLA J. WALES

(EDITOR'S NOTE:- The author of this article lost her life July 8, 1937, near Calgary, Alberta in a tragic accident which also took the lives of her parents, Mr. and Edward Wales and sister Estherruth (all of Auburndale, Mass.) while on a tour through Canada. Eleanor, another sister, was miraculously saved. We regret Miss Priscilla never lived to see her article in print.)

During the summer of 1936 we enjoyed a motor camping trip to Yellowstone Park. As a side-trip, we included the Craters of the Moon—about one and a half days' journey southwest from the southern exit of Yellowstone —across the gigantic, majestic Tetons— through miles of desert plains destitute of all vegetation but cactus and sagebrush, and devoid of all animal life but hundreds of Jack-rabbits and prairie dogs. Just as bears are traditionally associated with Yellowstone Park, we connect frivolous jack rabbits with the Craters of the Moon.

In the south-central part of Idaho is a portion of the Snake River plateau, which was created into a national monument in 1924, and which represents the most recent fissure eruption in the United States. It has been estimated that volcanic activity in this area continued intermittently for approximately 1000 years and probably ceased less than 500 years ago. Today, unusual and spectacular formations bear mute witness of an intensely fiery phase of this region's recent geological history. The monument's name was derived from the topographical similarity of the Craters of the Moon to the surface of the earth's moon as observed through a telescope.

Our first glimpse of the area revealed a dark, desert horizon broken only by a few rounded elevations which, as we drew nearer, we identified as craters and cinder cones. These project upward from a vast expanse of murky, black lava which marks the course of a basaltic flow. The lava is either the pahoehoe (smooth and ropy) or aa (rough and spiny) type. When the liquid basalt was extruded, it flowed in streams along the valley and low areas. As the moving basalt cooled, billowy wrinkles were formed. These solidified near the surface and the outer edges while the central parts moved onward to harden later. Thus were the crescentic masses of "ropes" or "curls" fashioned which are observed in the field.

Via an autochthonous, cindery, auto road constructed from the lava we traversed the part of the monument which has been developed. This constituted but a fraction of the total area of 80 square miles.

First we stopped to see a few odd, but extremely realistic, lava formations such as a huge, black, coiled snake! Then we resumed our drive to the spatter cones. It was possible to ascend circuitously several of these. At the summit of which we peered down into the interior. In one, only 30 feet below us, we saw snow and ice although the mercury registered 114 degrees Fahrenheit where we stood. Paradoxical as it seems, this phenomenon is possible, for the sun does not penetrate the crevasses and deep recesses of the lava where the snow and ice formed in the winter months. Since the lava acts as an insulator, it prevents melting.

Then we climbed to the summit of the Twin Craters (diameter: about 250 feet) via a human-trod path. Among the cinders on the slopes of the craters we observed many portions of heterogeneous bombs—the twisted, ribbon kind as well as the more substantial, ellipsoid type. A well-earned panorama of the region compensated us for the hot and tiring climb. Stretching before us the currents of the basalt flow

stood out clearly. Scattered along the periphery of that broad expanse were many craters and spatter cones, ranging in height from 20 to 600 feet—quiescent sentinels that testified to a more vigorous past. The jet black slopes of these conical protuberances sparkled gaily. This effect was produced by glossy lapilli scintillating among cinders. Some of the stiff, frothy foam of the molten basalt, turbulent in its onrush, coalesced very rapidly and produced the glossy surface which reflects colors and lusters of brilliant blue, green and gold.

As we continued along the ridge ride we saw many bombs of varying sizes and shapes (their diameters varied from a fraction of an inch to a few feet) scattered on the slopes. Volcanic matter, when molten, was ejected into the air. There it hardened and there the character of its movement determined its shape. In the air it became sufficiently hard not to break upon landing. Some of the resulting bombs are still intact; others have been broken by curious, inquisitive man. From the fractured ones we observed how the interior varies in degree of porosity which was caused by gas cavities. In general, the inner lining is more dense than the very porous heart which is often hollow. It is interesting to compare the outer surfaces, too. Some are fairly smooth, others extremely jagged and rough. The bread-crust type is rather common. While the bomb was still airbound, the outer layer hardened and the globular mass shrank. Then, as the compressed gases, confined inside, forced an exit, they made cracks on the surface which do resemble the crust of fresh, home-baked bread. Among the many other shapes of bombs, we noticed two in abundance: the ribbon and boomerang types. The first resulted when lava, ejected into the air as a long ribbon, waved, curled, and became twisted before falling to the ground; a similar process produced the second shape which has a handle, straight or sinuous, drawn out toward one end.

After leaving the section of the cinder cones, we trod upon the jagged surface of the buckled basalt flow by following several marked foot trails that led to caves and tunnels in cavities in the lava. These cavities were caused by the major part of the lava continuing to flow along its course after the hardened crust had become static. Dewdrop and Boy Scout Caves are examples. In most of the caves dripping water is found. The surface water trickles down through the porous lava and forms pools of ice-cold water which, in some instances, despite the enervating desert heat outside, freeze. In these caves delicate stalactites of various colors, predominately red and blue, are pendant from the ceiling. Many are coated with a white salty substance.

Another feature which interested us immensely was a natural bridge. The arch represents one current of molten lava which cooled and solidified while a cross current flowed transversely beneath it. The crust hardened while the main body of the undercurrent still flowed onward and was hard enough not to break in spite of the moving opposition. This is an observable example of the same principle which produced many interesting and spectacular subterranean tunnels in the region. "Indian Tunnel measures about 30 feet wide and several hundred feet long.

A very convenient traffic system conducted us around the developed portion of the Craters of the Moon and back to the entrance with repetition minimized. To the southeast lies a larger undeveloped area devastated by the same extrusive basaltic flow. The entire region, ghastly desolate, inky black, almost devoid of vegetation (though a few rare flowers and scrubby trees grow in the southern portion) vividly illustrates many aspects of vulcanism. To obtain a fair conception of the colossal havoc wrought here, one really needs to see it. When you visit Yellowstone Park, add the Craters of the Moon to your itinerary.

TOOLS FOR THE MINERAL COLLECTOR

By G. B. ELLERMEIER

On field trips, especially when they extend over a period of days, most mineral collectors will carry a hammer of some kind and a cold chisel. The usefulness of the hammer depends much upon its being of proper design, while the chisel may be dispensed with entirely in favor of the more efficient square point, described later. At times the chisel may prove handy as an aid to the square point, but if only one or the other of these tools can be taken along, by all means let it be the square point.

Preferably, the hammer should weigh about two pounds and be of the type known as the prospecting pick, the head of which bears on one end a flat face for hammering and at the other end a sharp pointed pick. Some may prefer the mineral hammer which is similar to the above except that a horizontal chisel cutting edge replaces the pointed pick. The prospecting pick will, however, prove to be a far more useful tool for all round purposes, and it is the type used almost exclusively by Western mining men.

The square point, and its compliment the diamond point, may be made by any blacksmith, capable of shaping and tempering steel, out of large cold chisels, or better still, have them made from a three-quarter inch bar of octagonal drill steel. If the drill steel be used, get a bar about sixteen inches long so that when cut into two equal lengths it will afford material for both a square and a diamond point.

The square point is made by drawing one end of the steel bar (or sharp end of the cold chisel as the case may be) out about two and a half inches to form a square point. That is, the tool will be brought to a point by the meeting of four flat surfaces each at a right angle to the adjacent surface. It should then be tempered very hard, just short of brittleness. In use it is a chipping tool and when its principles are mastered one will find it superior to the cold chisel, either for trimming specimens or for removing minerals from the parent rock. Because of its slender point one is enabled to work into crevices that a cold chisel cannot enter. Western ore miners use a similar tool, called a moyle, the difference being that the point is drawn out in a rounded form, about the shape of a pencil point when sharpened by mechanical means. The miner, however, is generally interested in recovering minerals as ore and not in trimming specimens or removing crystals unbroken from the matrix. The square and the diamond points are stone workers tools. Neither point should be used as a pry or lever for such misuse will very likely snap off the slender point.

The diamond point is purely a cutting tool, and takes its name from the shape of the point. In fashioning this tool, the steel bar is first drawn out to form a square point. Then without allowing the bar to cool it is clamped in a horizontal position in a vice so that one edge, or angle, of the squared point will be turned straight up. Then beginning about three-sixteenths of an inch back from the point, hot file on a slant from the upper edge down to meet the lower edge or angle. If properly filed, the point will, when looking down upon it, have a diamond or lozenge shape. It is then tempered very hard. In operation this tool is held so that the diamond is uppermost, a hammer furnishing the motive force. With it a groove or channel may be cut in even hard granite. Keeping the stone wet is some aid.

Perhaps an illustration will assist in making clear the use of these tools. On an occasion last spring, the writer was collecting topaz in the Thomas Range when a blast disclosed a fine crystal implanted in the face of the wall left standing after the blast. Of course the

crystal could have been picked out from its setting by using the square point when it would have afforded an acceptable loose crystal. But it would be even more desirable if a block of the matrix could be removed with the topaz seated therein. Anyway, something had to be done before firing another blast. So the diamond point was called into service. With it a groove or channel was cut around the crystal in such manner that the topaz resided in a rectangular block of matrix about three by four inches in size. As soon as the groove was cut to a depth of a quarter inch (when it became too narrow for convenient cutting) the square point came into use for widening the groove. This was accomplished by placing the point in the groove and chipping outwards, away from the topaz, until the groove was widened to an inch or more across. By alternately cutting with the diamond point and enlarging the groove with the square point, the groove was soon deepened to a full two inches.

The block was then slightly undercut on all four sides. Here the cold chisel, with its broad cutting edge, was of service, and this type of work seems to be about all that the cold chisel can be expected to perform with satisfaction. Setting the chisel in the groove, just above and at one corner of the matrix block, a light tap was delivered by the hammer. The chisel was then shifted over a little to one side and given a light tap, the process being repeated until the whole length of the top groove had been traversed, the purpose being to start the break in a straight line before delivering a heavy blow. Finally the chisel was set midway of the top groove, then a sharp blow on the tool broke the block neatly from the wall. Twenty-two minutes was the time required for the job. Rhyolite, however, especially when damp, cuts fairly well; a similar job in pegmatite would require somewhat more time.

Here it may be said that when badly dulled by use the tools—drills, picks, points—should not be sharpened by grinding. The proper way is to reshape the tool by hammering while red hot from the forge, and then temper. Otherwise, the life of the tool will be short. For that reason many collectors, who spend considerable time afield, have learned to shape and temper their own steel. Most mines and quarries have forge and anvil; at most mines the man who does the tool sharpening will not only grant the use of his blacksmithing facilities but will evince considerable interest in observing what kind of artistry, or lack thereof, will result from the loan of his tools. And that affords a good opportunity for the exchange of ideas.

The gold pan, or prospecting pan, as it is variously known, may be carried with advantage by all who seek minerals in the Rocky Mountain states, and it may prove of value elsewhere in sampling gravels for small crystals. Not only do many gulches throughout the western regions carry some placer gold, but other minerals also may be recovered by panning, most conspicuous of which are garnets and the "black sands", composed mainly of magnetite and hematite. Often small crystals of zircon, topaz, epidote, rutile, or grains of monazite accompany gold in the sands and gravels of stream beds.

The technique of the prospecting pan has been fully described by Blair (1), and the writer does not deem it necessary at this time to discuss the method of operating a pan. The mineral collector should bear in mind that it is not necessary for him to discover "pay dirt", in the mining sense, in order to obtain a quantity of concentrates that will afford an interesting specimen. Better still, with good luck and perseverance, he may collect enough fine gold to fill a tiny vial. And of all specimens in the cabinet, none will prove of more interest and of greater beauty than a tiny vial of virgin gold resting, like crown jewels, on its little pillow of blue velvet.

(1) Blair, Jonathan McC.—Gold. Rocks and Minerals, June 1937, p. 165.

RAMBLING ROUND CISCO, UTAH

By W. C. MINOR
Fruita, Colo.

Traveling west on highway U. S. 50 about the first thing you see after crossing the line from Colorado into Utah is a large sign by the side of the road which reads: "Speed limit 50 miles per hour". Most motorists step on the accelerator a little harder and "hold 'er to the limit". The drab colored, bare and lifeless looking desert hills and mesas rolling away on every side have little interest for the average traveler. They consider the desert an unattractive stretch of territory to be put behind as quickly as possible. But if the traveler should happen to be a geologist or a collector of minerals and fossils, ah that's different! As far as known, there is no gold in "them thar" desert hills but there are other things just as interesting.

The first time the writer ever hunted for specimens in the Cisco country was with a party of hikers led by F. W. Bocking well known geologist and collector. Since that time he has made several other trips with Mr. Bocking as well as numerous trips with Professor Philip Grebiel of the Fruita High School, George Porter Jr., and C. S. Kirkendall all of Fruita, Colorado, and all enthusiastic rock-hounds. Rarely indeed do we return empty handed from a day's prowl in this unique territory.

A few miles west of the state line you come to a small store and filling station called Harley Dome. A faintly discernible dirt road leads out across the desert north from Harley Dome. A mile or so out along this trail is located an immense bed of fossilized sea shells. This deposit of shells is approximately a mile long and several hundred yards in width. Several different species of fossil shells are found here, sometimes piled up in heaps like gravel along a creek bed. Unfortunately, most of the shells are broken and perfect specimens are rarely found here. About half way between Harley Dome and Cisco along one of the desert washes and to the south of the highway is another, but smaller, deposit of fossilized shells.

Some ten miles east of Cisco along the side of one of the low mesas one-fourth mile north of the highway is a deposit of fossil coral. This coral is of the honey-comb type, sometimes called petrified wasps' nests. It seems odd to speak of sea shells and coral on the desert more than a thousand miles from the ocean but scientists tell us that millions of years ago much of this mountain desert country was beneath the sea.

By this time you may think that my directions for finding these various interesting localities are rather vague and hazy. But to anyone who is not acquainted with the country the desert hills and low mesas nearly all look alike. There are few recognizable landmarks to be described, so it is practically impossible to describe a place clearly enough that anyone not familiar with the locality could be at all certain of finding the exact spot.

Cisco is a typical small desert town, and like many other small towns often causes the traveler to wonder just what excuse they have for existing in such a place. However, Cisco is the railroad center and shipping point for a number of ranches and a vast area of surrounding mountain and desert country. It is a busy place during sheep shearing time and shipping time.

The hills along the Colorado River south of Cisco contain some good material. One day, some time ago, a party of collectors, consisting of Messrs. Kirkendall, Brumbaugh, Brown, Campbell and the writer, made some interesting finds in this locality. Mr. Kirkendall and the writer while hunting together found three agatized clams. These shells were much larger than the usual fossil clams found here, nearly five inches long, and seemed to be perfect specimens. However, they were firmly

embedded in a huge block of sandstone and as we had no chisels with which to cut them out we were forced to leave them. The other members of the party were mainly interested in fossilized dinosaur bones of which they found as one of them said, "A carload or so". Some of the pieces were fairly large, fifty pounds or more, but as there did not appear to be anything new in the lot only a few small specimens were taken. We all had our pockets full of agates, jaspers and dinosaur gizzard stones. The writer found two nice Indian arrow heads, one of opalized wood and the other of black jasper. But the prize find of the day was made by Mr. Kirkendall when he discovered a log of opalized wood in a cliff. The log was located near the end of a small gulch. The trunk was ten inches in diameter and some twelve feet of it was exposed to view. Both ends, however, were firmly embedded in the cliffs on either side of the gulch. The outside of the log was a grayish-white color almost exactly the same in appearance as a weather beaten old fence post. At several places along the trunk small pieces had broken off disclosing the interior of very pretty blue-gray opal. This tree trunk appeared to be solid and not cracked or fractured like so much opalized wood is. It would have made wonderful cutting material but we, of course, had no way of removing the entire thing and it seemed a shame to break up a specimen like that so we just left the whole thing.

A good road leads south of Cisco some five miles to the D. & R. G. W. pumping plant on the Colorado River. The gentleman in charge of the pumping plant at the time I was there is evidently an enthusiastic collector. I visited the pumping plant only one time and that was on a Sunday and no one was home so I never even learned the name of the person who made the collection displayed there. But arranged about the grounds around the house is an extensive and unique collection of rocks, fossils and geological specimens gathered from the surrounding territory. This collection is worth going a long way to see.

A short distance before reaching the pumping plant a dim road branches off to the left. You may have to look twice to see it as the land is very rocky at this point. Before the present highway was built this was the main road between Cisco and Westwater. Today it is little used and may be impassable, especially just after a desert storm. But a mile or two out on this road and the collector is amply repaid for the rough going by reaching the largest bed of agate that the writer has ever seen. This agate bed covers approximately one square mile. Not all of the mile, of course, is covered with agate, but it is found in spots more or less plentiful over the entire area. Like all large deposits of agate, much of the material is of very poor quality. Some, however, is excellent. The agate is mainly of the type known as blood agate, which is a pink or orange chalcedony. Some of the pieces will be of one solid color, others will be banded or mottled with clear chalcedony. There are many different shades of color from a very pale pink to almost red. This deposit also contains a small amount of an odd translucent yellow agate in which thread like streaks of red agate forms loops, whorls and circles. This latter makes very fine polished specimens and is rather rare and much sought after. Most of the agate in the bed is found in broken pieces ranging in size from tiny flakes up to three or four pounds. Huge broken amygdules, some of them two feet or more in diameter, lie scattered about. Some of these have nice quartz crystal centers. Unfortunately, in most of these large pieces the agate is of poor quality and color and is not suitable for specimens. Most localities where agate is found are hard to reach but the road runs right across this bed. Doubtless many collectors, like the writer, have spent many days hunting for agates and felt well repaid with a pocketful of specimens to show for a

day's hunt. But here the task is not finding the agate but selecting the best specimens and trying to keep from picking up more than you can conveniently carry. During olden times Indians doubtless traveled long distances to this agate bed to get the colorful material for making arrow heads. Arrow heads of blood agate have been found hundreds of miles from any known deposit of the mineral.

A short distance west of Cisco a road leaves the highway to the left and curls down across the desert in a southernly direction to the Colorado River. It crosses the river at Dewey Bridge and follows on down the river through Mirror Canyon, Castle Valley, Whirlpool Canyon and on to Moab. This is the noted Cisco to Moab Canyon Drive and is a trip that should be made by every tourist who really wants to see the country. The road, though good, is very narrow in many places and when cars meet on these narrow stretches one of them may have to back for as much as half a mile before they can find a place wide enough to pass. In spite of this slight annoyance visitors usually feel well repaid for making the trip by the majestic, rugged scenic beauty of the canyons. The narrow road winding along between the cliffs and the river, the towering walls of red sandstone on either side reflecting in the water and contrasting sharply in color with the bars of dazzling white sand along the river make a long to be remembered sight. In addition to startling scenic grandeur there are mineral specimens to be found along the way. But that, as the novelists say, is another story.

A GEOLOGICAL ODDITY FROM MONTAUK POINT, NEW YORK

By EUGENE W. BLANK

Long Island is made up of the remains of two terminal moraines which stretch the entire length of the island (1) (2). On the extreme eastern tip of the island stands the Montauk lighthouse of 220,000 candlepower.

The beach at Montauk is littered with countless smoothly polished pebbles as a result of ancient glacial wear and present wave action.

The writer recently found a most unusual geological specimen on this beach. It is a quartzite rock roughly oblong in shape, about 2½ inches square and 5 inches long with a layer of Hematite about ¼ inch thick intersecting diagonally across one half of the specimen. The rock was found at the water line during low tide.

What arouses interest in the specimen is the fact that the relatively softer Hematite extends out of the rock along two sides, at places projecting as much as ¾ inches.

It is hard to explain why the harder rock has been so evenly worn away leaving the Hematite to project since the latter is softer and readily breaks away under pressure. The only possible explanation is that while mechanical erosion might have selected the softer Hematite for attack the solvent chemical action of the sea water operates in an opposite manner dissolving silica more rapidly than iron ore.

The fact that the specimen was sheltered between larger boulders prevented mechanical erosion due to rolling on the beach since movement of any sort would undoubtedly have broken off the projecting Hematite.

Thanks are due to Mr. A. J. Frantz both for calling the attention of the writer to this interesting specimen and also for his labor in photographing the same.

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(1) J. R. Smith, "North America", p. 165, Harcourt, Brace and Co., New York (1925).
(2) "New York City and Vicinity", p. 18, Int. Geol. Congress Guidebook No. 9, Washington, D. C. (1933).

BIRTH OF THE OPAL

Mere Nature's Master Chemist, in his cavern far below,
Once labored without ceasing, oh, so many years ago,
For lo! He had before him, as a duty to be done,
The blending of the beauties of all precious gems in one.

He chose a glowing ruby in whose crimson heart there shone
A tropic sunset's splendor, like a flame turned into stone.
An emerald was second, of a vibrant, virgin green,
The living light of summer or a sun-kissed breaker's sheen;

And then a golden topaz, plus garnets, two or three;
A turquoise rare that rivaled fair Bermuda's magic sea;
An amethyst so regal, of the richest purple hue,
The color of the rarest grape that vinyard ever grew.

He chose a limpid sapphire of the most celestial blue;
A breathless, soaring color, far too thrilling to be true;
An oriental lapis, like the star-lit, velvet night;
A mystic alexandrite, with its green and ruby light.

A multitude of others were next added to the rest
In crucibles of diamond that wou'd stand high heat the best.
For days the priceless jewels were exposed to searing flame
And melted to a magma by a man without a name.

Not satisfied, he added, in a swirl of pearly mist,
A galaxy of blossoms that sun and wind had kissed;
He stole the fairest rainbow, and he robbed both sea and sky
Of evanescent beauties that are born, so soon to die.

The master cooled the mixture, then beheld the finished prize,
For lo! A lovely opal stood before his startled eyes;
A symphony of color, a rhapsody, a dream,
Gay harmonies of happy hues that dance and glow and gleam;

Preserved in stone the glory of the flowers than soon fade,
The splendor of the bright-hued birds that our Creator made;
All vibrant tints of heaven, all precious stones of earth;
A combination of them all thus gave the opal birth.

BETTY BROWNE, R. T.,
Pittsfield, Mass.

COAL MADE TRANSPARENT

Specimens of coal, cut so thin that they are translucent, have been mounted at Field Museum of Natural History under lighting conditions which make them virtually transparent. They illustrate strikingly the fact that when a person burns coal he is really burning wood, for these films of coal are seen to be composed of massed fragments of wood and vegetation from forests of the Coal Age, some 250,000,000 years ago. The exhibit is of interest in connection with the museum's restoration of a Carboniferous forest, life size and as it appeared in life.

TEACHING ROCKS AND MINERALS IN HIGH SCHOOL

By M. H. SHEARER

Westport High School, Kansas City, Missouri

Those who think that the average high school student cannot become interested in the study of rocks and minerals are badly mistaken. As with any study, a great deal depends upon the method of approach and the efforts and skills used by the individual teacher in making the study **interesting.** Of first importance is the necessity of having available plenty of material so that **each student can handle more than one specimen of the same rock or mineral.** A well-known human characteristic is the desire in each of us to get our hands on the material things that we may be studying. The handling of rocks and minerals helps to bring out certain properties, especially weight and structure. Viewing a specimen from different angles provides a more correct conception of its true color and in some cases the crystalline form.

The study of rocks and minerals is a part of a full year course in physiography offered in the senior high schools of Kansas City, Missouri. At the present time over 1,000 students are enrolled in this course. As an introduction to the study of rocks and minerals, an hour is devoted to the discussion of chemical elements and chemical compounds. Emphasis is given to the elements that are metals, and some idea of their relative weights is ascertained by noting the atomic weights. Effervescence of certain substances in acid is demonstrated by letting the students put drops of hydrochloric acid on limestone or calcite. All students are required to memorize the symbols of the more common chemical elements. Then follows a discussion of the characteristics of minerals used in identification. The more common crystalline forms are diagrammed and shown by wooden models. Several pieces of calcite are passed around the class to allow each student to demonstrate to himself or herself the characteristic of double refraction. This catches the student's interest and curiosity immediately. To show the hexagonal crystal, several beautiful specimens of amethyst are passed out to be examined. Girls especially will admire the amethyst, and their interest in the new study is stimulated greatly. The cubical crystal is shown by letting students handle several large pieces of clear rock salt from mines near Salina, Kansas. In some of these specimens can be seen tiny bubbles of water, and interest is again stimulated by asking the class to ponder or even guess at the length of time that those bubbles have been in captivity. In the study of structure, most interest is probably displayed in the thin sheets of mica and the silky fibers of asbestos. Then comes the master stroke when, in the study of color, pupils are allowed to handle beautiful specimens of polished agate, malachite, marble and granite.

During the past few years our supply of both rocks and minerals has been greatly increased (1) from annual purchases and (2) by donations from students of former years. In our ten classes in physiography, of which the study of rocks and minerals is a most important part, are enrolled over 300 Juniors and Seniors. These people travel during the summer months, some very extensively, and they are urged to collect specimens enroute. The result is in many cases that the student not only secures a specimen for himself but will also bring one back to the school. Last September one girl gave us several pieces of lava that she had brought all the way from Hawaii.

As our study of mineralogy progresses more and more samples are placed in the laboratory. It is perhaps wrong to start

out with **all** samples on display. The student may look over several tables covered with boxes of specimens, and the large amount of material in sight may stagger him and cause him to conclude immediately that he cannot learn what all that "stuff" is. The writer believes this point is very important. The teacher should begin with **many** specimens of a **few** minerals. Another great aid is a system of numbering. As each mineral is discussed, it is given a definite number. On certain tables in the laboratory are boxes containing **numbered** specimens, and on other tables are the **unknown** or **unnumbered** specimens. Another aid is given by a large number of **labeled** specimens that are on display is two show cases. After four or five days of mineral study, easy preliminary tests in identification are given, and even the students themselves are often surprised at the rapidity with which they have learned the outstanding characteristics of certain minerals. They are required to learn to identify a total of about 30 or 35 minerals.

Rocks are learned according to the classification igneous, sedimentary and metamorphic. Numbers on rock specimens are preceded by the letter "R" which immediately informs the student that he is looking at a rock and not a mineral. All numbered specimens of igneous rocks are put on one table, sedimentary on another, and metamorphic on a third. In this way about six or seven rocks belonging to each class are learned. Local quarries and marble works have donated some beautiful specimens of decorative building stones. Along this same line, a big gypsum company has given us a complete display of their products.

In conclusion it should be repeated that success in teaching rocks and minerals depends to a considerable degree upon the efforts of the instructor to **secure the interest of the students during the first three or four days of the study.** Nothing could be worse than to start out with a detailed study of complex crystalline forms involving difficult geometrical construction. Such belongs strictly to the advanced college course. This brief article has been written in the hope that some of the ideas expressed may be of help to the teacher of physical geography, geology or mineralogy. And we teachers need the active cooperation of all other rock and mineral enthusiasts. We urge you to keep talking to administrators, especially of secondary schools, and to point out to them the desirability and value of a thorough high school course in earth science (physical geography or physiography) which includes a study of the materials of the earth's crust, those inorganic substances that have meant so much to human progress.

MINERALS AND MINES OF SPRINGFIELD, NEW HAMPSHIRE

By JOHN M. ULRICH

The writer of this article has long been familiar with the mineral localities of the town of Springfield, Sullivan County, New Hampshire and has been most fortunate in securing many good cabinet specimens within that vicinity.

The rock formation underlying this section of central New Hampshire is for the most part pegmatite in which occur veins of mica intermixed with feldspar. In the past there was much mining through out this section, especially near the end of the last century, but today most of the operations have ceased owing to a poor market in commercial feldspar and an over production of mica in other quarters. Today, therefore, the old mines and quarries of Springfield are deserted, the pits full of water, the hauling engines covered with rust and the old roads leading to the diggings grown up with brambles. Without an intimate knowledge of their existence, one could wander about for days before he stumbled upon the old locations but by this same reason the mines and quarries are even today a paradise for collectors.

The writer first penetrated this region while fox and bird hunting and in the course of these excursions chanced to visit the mines and examine them in a superficial manner. He returned the following summer, just for the avowed purpose of searching among them for specimens for his own cabinet and was well rewarded for his search.

The best known and easiest mines to reach are the Globe, Murphy's, United and Pillsbury. All of these are both mica and feldspar mines. The Globe Mine is located in the central part of Springfield Township about a mile north of the fourth New Hampshire Turnpike road and is reached with difficulty by an old disused wood road that winds through the steep hills. It was first opened up in 1887 and has been worked at irregular intervals since then. At the present time there is a lapse of operation and most of the pits are filled with water but the dumps offer some interesting specimens of large jet black tourmalines of perfect crystallization. On the same ledge but further to the north and about a mile away from the Globe is Murphy's Mica mine which offers a diversity of minerals. Large muscovite crystals hexagonal in outline and some of these in plates a yard across and perfectly transparent occur here. Next we find here cavities in granite in which are well formed crystals of orthoclase together with some topaz, tourmaline and other semi-gem crystals. An old tunnel leading into a hill side terminates at the base of a vein of pink feldspar. This mine is well worth a visit but one must be prepared to wade through a jungle of blackberry bushes to get to it.

In the extreme western part of Springfield on a spur of Bucklins Mountain is located the United Mica Mine. This has been worked extensively in recent years and has produced an excellent grade of feldspar which is used in the manufacture of soap and cosmetics. A series of graded tunnels entering the mountain at different levels affords an easy access to the veins of spar and mica. It is not necessary however to enter the mine proper as the old dumps are the best places to look for sizeable specimens. Here the writer has found large green imperfect beryls, andradite garnets, some small green crystals of vesuvianite, oligoclase crystals and massive microline.

The Pillsbury Mine, situated directly on the top of the height of land known as Pillsbury Ridge, is a small working that has in the course of mica mining produced some fine museum specimens

of beryl and a few nice aquamarines. It is only a few miles from the Grafton town line which of course is known all over the world for its huge beryls. Alas, although the author spent two days in exploring the dumps of the Pillsbury mine he was only rewarded by finding one clear green beryl imbedded in a granite matrix. He has, however, seen some of the aquamarines in the collection of a local resident, from this mine, some weighing 75 to 100 carats, ranging from pale green to yellow translucent crystals. In most cases the beryl crystals of this section cannot often be separated from the granite matrix without breaking.

While the author has outlined only a few of the mines of special interest in Springfield township, it should be understood that there are many other good locations for minerals besides these in that section. Some good amethyst crystals have been found at George Hill being blasted out of a granite ledge. Tourmaline in fine black crystals occur in the Fowlertown district. Small but perfect red Garnets are found in a ledge, west of the Springfield—Grafton Road about a mile near the Morgan Camp. These are a few of the other places one might mention.

In the estimation of the writer, Springfield, N. H. has much to offer for the mineral collector at large and has not yet been spoiled by any over abundant rush of rock enthusiasts, protected by a natural terrain of rugged hills and impassable back roads, this little town will be a good hunting ground for mineralogists for years to come.

THE BIG HORN MOUNTAINS OF WYOMING

By I. N. TAYLOR

The Big Horn Mountains are a range of mountains west of Sheridan running in a northwest and southeast direction for about 60 miles and 35 or more miles in width.

Cloud Peak with an altitude of 13,-163 feet, dominates the cluster between Piney and Goose creeks. In this high area ridges rise from 3,000 to 4,000 feet above the valleys the general configuration is very rugged. There are many precipices over 1,000 feet high.

There has been over 200 mining claims located on which are 48 veins of mineral-bearing rock, these veins are from 48 inches to 300 feet in width, specimens of gold, silver, platinum, asbestos, lead, uranium, iridium, molybdenum, copper and tin, and several other minerals more common have been found.

Seventeen formations are exhibited in the Big Horn Mountains, with a total average thickness of 14,175 feet (vertically) most of them contain fossils. The older formations outcrop in the higher areas, while the younger appear near the plains comprising pre-Cambrian granite overlain by thick series of Paleozoic and Mesozoic sedimentary strata afford a stratigraphic record from the earliest geological time to the present. Over a thousand square miles of granite are exposed; granite which more than 30 million years ago was formed from Magmamolten rock that welled to the surface from the depth of the earth. At intervals the granite is traversed by dikes—later intrusions of molten rock following crevices to the surface.

Many relics of the dim past lie buried in the virgin soil and in the mountain areas of this region. Ammonites, Trilobites, sea shells, coral, etc. can be found, besides this area furnishes an interesting scientific study for those interested in geological formations, and to those who desire to see evidence of nature's handwork which dates down through the ages.

Despite the fact that the Big Horn Mountains lay in the heart of a region abounding with romantic lore, the location of many of its historic spots are not well marked nor brought to the attention of many persons who would be interested. Relics have not been preserved nor ruins reconstructed and the history connected with them is but vaguely known even to many residents of the region.

It was in the early nineties that gold strikes were first reported in the Bald Mountain district. Bald City, named after the mountain on which it stands, is often referred to as Gold City or the City of Broken Hearts. During the few years the little village of about 40 log cabins flourished, its population was estimated to have reached 300 inhabitants. Families were few, the populace being mostly men who spent the summer months panning gold or attending their places of business, returning into the valley during the winter until the snow melted sufficently to permit their return. But now all that remains is a ghost city.

Another mining venture in the Big Horn Mountains was the Nickel Plate company who started their mining operations by digging into the side of the mountain where they found sufficient indications of copper and nickel to start a shaft. A shaft 65 feet was sunk before the mine was abandoned because no large veins of ore were found.

However, it is believed by the miners that copper was prevalent because tools left in the mine over night were discolored by water that seeped in through the rock. And the blades of shovels

left standing in the water that seeped into the mine shaft would in a few hours acquire flowery designs of green substance.

One of the many wonders of the Big Horns is the mysterious Medicine Wheel. A crude symbol of a wheel, outlined by loosely piled limestone rocks, laid in place by hands of some forgotten race is on the high promontory of Medicine Mountain. The date of this World's Oldest Calendar is about 10,007 B.C., thus making this symbolic calendar 12,940 years old.

The early days of the Big Horns were colorful days and the pages of frontier history are thickly scattered with mysteries which will never be explained.

LA PORTE, IND., METEORITE PRESENTED TO FIELD MUSEUM

A highly valued meteorite specimen, which fell at LaPorte, Indiana—closer to Chicago than any other known meteorite—has been presented to Field Museum of Natural History by the estate of the late William Rumely, of Chicago and LaPorte. Richard L. Rumely, of Chicago, son of the original owner, acting on behalf of the estate, arranged for the presentation of the specimen.

The meteorite is one of the rare group known as hexahedrites, according to Henry W. Nichols, chief curator of the department of geology, who has completed a preliminary study of the specimen. This type of meteorite has a unique composition and structural form, found in only one out of twelve iron meteorites. The specimen received weighs thirty-two pounds, and is about the size of an average man's head. It was found and removed from the ground in the year 1900 by a farmer in the vicinity of LaPorte, who brought it to the farmer's supply store then operated in that city by William Rumely. Mr. Rumely recognized the interest and value of the specimen, and kept it among his most cherished possessions.

The time of the meteorite's fall is unknown, but a guess, based on its excellent state of preservation, would indicate that it could not have been in the ground more than ten or fifteen years before it was found, and it is possible that it was found only a short time after it fell, states Mr. Nichols.

CAMP CROCKETT GOES GEOLOGIC

By F. C. KESSLER
Canon City, Colorado

Turn in at the big red gate just four and seven-tenths miles north of Rye, Colorado, on State Highway 165 and you will be a welcome guest at the summer camp of the Pueblo Y. M. C. A.

As you drive up from the big red gate to the lodge, a distance of less than two miles, you will gain 500 feet in altitude. Your car will boil and perhaps your driver as well. The high cliff on the right as you drive up is Dakota Sandstone of a modest buff color, engraved with Indian writing that probably dates back to 1778, when Chief Cuerno Verde was killed by the Spaniards in battle nearby. Cuerno Verde is the Spanish term for Greenhorn after whom the range of mountains was named.

This sandstone is the chief building stone in the foot hills of the Rocky Mountains. During the summer the boys at camp made a grindstone of it on which they sharpened their tools for handicraft. The ranchers build milk houses and wall their cellars and wells with it. The walls and three of the cell houses of the state prison at Canon City are built of it and some of the buildings on the college campus at Colorado Springs are built of this same beautiful sandstone.

Diagonally across the camp site extends the contact of the Dakota and Pre-Cambrian formations which at some places is so distinct that one can stand with one foot on sedimentary and the other on igneous rocks. In the sedimentary formation is found Cretaceous plant fossils that grew and blossomed more than fifty million years ago. In the igneous formation no trace of life is seen. It must have been formed countless millions of years ago. To this contact Mr. Rauze, the camp director, takes his groups for practical demonstration in the study of the earth's history. To the east lie sandstone and shale that tell by means of their fossil language as distinctly as the pages of a book that there once was an inland sea. To the west the Greenhorn Mountains rise to 12,500 feet within eight miles of the camp. The orogenic movements took place during the Cretaceous period. Since that time erosion has carried away the non-mineralized portions of the earth's crust and has left the pegmatite dikes running up from the sedimentary hogbacks toward Greenhorn Peak which stands there like a grotesque octopus with its head above timberline and its tentacles reaching down to the old sea bed now the Great Western Plains.

There are five of these great dikes on the camp side of Mt. Greenhorn and each has its characteristic minerals. The one to the north consists chiefly of feldspar. Indian Lookout is a feldspar cliff and Crockett Falls drops over a feldspar ledge. On the next dike over which leads the Phillip Crusader's trail, schist is the country rock. It glitters in spots with mica and garnets. On the Mill Site dike is green epidote with zircon or columbite crystals. Gneisses and schists, rich in cassiterite, constitute the other dikes.

During the summer the hikers brought specimens of these rocks and minerals into camp and arranged them systematically in a large six-shelf display cabinet. Each specimen was placed on a disk sawed on a bias from the end of a pine pole with the bark on it, then the disk was labeled to identify the specimen.

The mineral collection became the master-key of the mountain treasures, because it served as a reference shelf for the boys when the camp program called for a treasure hunt. The instructions for the hunt often required the hunters to get a garnet, or a feldspar crystal from a certain hill and then and there the hunter learned to know the minerals by comparing his find with those in the cabinet.

THE AMATEUR LAPIDARY

Conducted by ARTHUR KNAPP
1401 Arch St., Philadephia, Pa.

Amateur and professional lapidaries are cordially invited to submit contributions and so make this department of interest to all.

GRINDING & POLISHING A SPHERE

Edited by H. L. PERDIUE

(EDITOR'S NOTE:- *This is the second of a series of articles written by John Vlismas, Professional stone Craftsman, of 244 East 77th Street, New York City).*

There has been considerable mystery surrounding the art of grinding and polishing stone into perfect spheres. It has been said that the Orientals were the only ones capable of doing this work, and that it requires months of patient work to complete a sphere. It is true, that the Chinese and Japanese do make beautiful spheres, and it does take a long time for them to complete a job. They have no monopoly on doing this work, however, and you can do it just as well in only a fraction of the time if you have the proper equipment.

The first step in making a perfect sphere is to take the speciman and cut it into a cube with all sides square, and approximately equal in size. The distance between faces of the cubes should be slightly greater than the diameter of the sphere you wish when finished. The process of slicing was described in my previous article and should be followed with care.

The next step is the rough grinding. The coarse wheel should be mounted, making sure that it is held firmly between the flanges. It must be securely fastened so there is no danger of vibration while the wheel is turning. You must also make sure that the speed of the wheel is not too great. My coarse 10" wheel runs correctly at 1750 rpm.

A small stream of water just be allowed to run on the wheel at the point of cutting. This does two things: It helps cool the speciman, and at the same time, washes out the particles cut off and also the grit broken away from the wheel. The water may be taken from the house connection or from a tank or bucket mounted above the table.

After you are sure that the wheel is set up correctly and there is a place for the waste water to flow, you can begin grinding. The cube should be held by hand and each of the eight corners cut flat. When this is completed you will have a sixteen solid using either the edge or top of the wheel, eight faces of which are octagonal and eight of which are triangular. In cutting you can tell whether you are taking too much or too little stock by the feel. With a ¼ hp. motor you can stall the motor if you cut on the edge of the wheel and press hard enough. This is entirely too much pressure, since the motor should slow down only slightly under proper cutting conditions. If you press too hard you will only clog and wear down the wheel and possibly ruin your motor.

After the first eight corners are cut you should then begin to take off all the other corners, always cutting in a plane perpendicular to a point in the center. This should be done until an approximate sphere shape is obtained. You will then have some high spots because your grinding will not be perfect. These should be rounded off by grinding and turning the speciman at the same time. You now have a sphere. It looks terrible. It is lopsided and rough, but do not worry, it will be perfect when you get through.

The next step is to remove the rough

grinding wheel and mount the Sphere Adaptor on the end of the spindle. Again water is made to flow into this adaptor, this time only at a rate of a few drops. A quantity of rather coarse carborundum or chrystolon grit approximately No. 60 should be placed in a flat shallow container. Your approximate sphere should then be wet and covered with the grit. Now the machine is started up, and as the water drops into the adaptor the speciman is placed into the adaptor and turned in all directions by hand. You continue to turn the sphere as the machine rotates, and as required add more grit in order to continue cutting. One must make sure that the ball is kept moving so that it will become perfectly round and no ridges will be cut on the surface. A word of warning is necessary at this point. As you continue to cut down the sphere the adaptor may become worn at the same time, and form a sharp edge at the top. If you are not careful you may cut your fingers on this edge. It should be made dull by an ordinary file.

After the above operation is completed you now have a sphere which is perfect, as far as dimensions are concerned, but the surface is rather rough. You must repeat the last operation, using No. 150 grit. After considerable grinding the surface will become smoother. You now repeat this same operation, using No. 460 grit. This leaves you with a smooth perfect surface and no scratches visible to the naked eye. This can be accomplished only if you take extreme care to make sure that none of the coarse grains used in a previous operation touch the sphere while grinding. It only takes one coarse grain on a cloth, in the adaptor, or on your hand to scratch your speciman and cause you long hours of grinding with fine grit to remove especially if the specimen is of hard material.

Now that you have ground the sphere it is perfect in size and as smooth as can be made with abrasives. Next comes the polishing operation. The grinding adaptor is removed and the felt lined Polishing Adaptor is mounted on the spindle. Now with the spindle turning at the same speed, the same process is used as described above. In this case, instead of using an abrasive you use Kio polishing compound. Again, with a few drops of water dripping on to the specimen you apply the Kio polishing compound in the same way that you previously applied the abrasive. This polishing should continue until a beautiful film is worked up on the surface of your sphere. Here again, I want to point out that fingers, felt, and everything coming in contact with the sphere must be free from grit, otherwise you will find disappointing scratches.

I believe you agree that this process as described is simple and easy. After some practice you can make a small sphere of soft material in as short a time as twenty minutes. To begin with, however, it will take you considerably longer. You should be able to make beautiful two inch spheres with hardness up to 4 in two hours the first time you try.

Beauties beyond your conception can be brought out by making spheres. You will find asterism in some quartz, and depth of color in agate, labradorite and other semi-transparent stones.

In making beads, the same process is used, except the holes for stringing are bored thru the center of cubes before starting to rough out the sphere.

The Lithocraft machine is especially adapted for making spheres. Several women have had success in using this machine for this purpose. Mrs. Oterson of New Haven, Conn. has been very successful in this respect and has nothing but praise for the machine. Mrs Sherman, now in the Philippine Islands, had also made spheres with this machine. I might point out that this is the only method of making spheres up to four inches in diameter without considerable experience.

EDITOR'S NOTE: *The above article refers particularly to the softer stones, as calcite and marble. Quartz requires the use of extra intermediate steps with graduating grades of abrasive.*

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HANDBOOK FOR THE AMATEUR Lapidary by J. H. Howard, 16 chapters covering al phases of gem cutting and polishing, 150 pp., 44 illus., price $2.00. J. H. Howard, 504 Crescent Ave., Dept. R., Greenville, S. C.

CURIOS

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BEAUTIFUL BANDED AGATE, POLished one side: 1x2 inches, 45c; 1x3, 65c; 2x2, 85c; 2x3, $1.10. Postpaid. No two alike. From Washington and Oregon. E. A. Southwick, 528 S. E. Washington St., Portland, Ore.

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THE GEM MINERALS OF SAN DIEGO CO., CALIF. A mimeographed copy of this article which describes all gem minerals and localities of this famous gem district will be sent with every copy of our new cataog listing our extensive stock of Kunzite. A new price list is now available listing rough gem minerals and all crystallized minerals in our stock. These catalogs will be sent upon receipt of 10c in coin or stamps. Each catalog contains a coupon worth 25c in trade. Warner and Grieger, 405 Ninita Parkway, Pasadena, Calif.

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MINERALS

SALMON CALCITE—JUST RECEIVED a small shipment of this beautiful mineral from an exhausted locality in Orange County, N. Y. The locality is obliterated and no more specimens are to be had. While they last—50c and $1.00 each. Peter Zodac, Box 29, Peekskill, N. Y.

MINERALS

FAMOUS HERKIMER COUNTY "DIAmonds." My former offer of 15 xls, six sizes, with 25 miniature xls for $1.00 still holds good. Every collector shoud at least have this set. Also have right and left hand xls, several forms of twins, carbonaceous and other inclusions, xls in matrix, etc. Correspondence solicited. Postage appreciated. W. J. Hollister, R. M., Little Falls, N. Y.

AGATES, JASPER, PETRIFIED WOOD and Opalite! For cabinet specimens or cutting. Only handle Texas material collected by myself. 1" specimens of above material 10c each prepaid. 25c and up per pound. Postage extra. Special prices on large quantities. Questions answered where stamp is inclosed. Frank Duncan, Terlingua, Texas.

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DISCONTINUING MINERAL SELLING —We still have a good many interesting specimens that we are SELLING OUT at John Grenzig's, 299 Adams St., Brooklyn, as we have given up the selling of general line of minerals; also 50 in. General Electric Cooper Hewit Fluorescent D. C. lamp, slightly used. Good time to buy now. Stephen Varni Co., GEM CUTTERS, 584 Fifth Ave., New York.

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CHIPS FROM THE QUARRY

CURATOR TOOTHAKER IN GREENLAND

Charles R. Toothaker, Curator of the Commercial Museum, Philadelphia, Pa., is in Ivigtut, Greenland, examining the world famous cryolite deposits. We have hopes that Mr. Toothaker, on his return, may be persuaded to prepare for **Rocks and Minerals** an article covering his trip and the cryolite occurrence.

CAPLAN MOVES TO GOLDEN

Allan Caplan, mineral dealer in Boulder, Colo., has moved to Golden, Colo., in order to take up graduate work in geology at the Colorado School of Mines. He will continue to deal in minerals and has a large assortment of interesting specimens in his stock. See his ads in this issue.

SOUTHERN SUBSCRIBERS VISITED

Peter Zodac, Editor of **Rocks and** Minerals, **and Dr. J. R. Evers spent one** full week examining mineral localities in Virginia, Maryland and Pennsylvania. Many localities were visited and some very interesting occurrences noted but what impressed the visitors mostly were the many courtesies extended them by southern members. The staff of the Virginia Geological Survey extended them many privileges and were most gracious in furnishing notes on the mineral occurrences of their state; Mr. and Mrs. Oliver Wilbur and son Robert of Waynesboro, Va., entertained the New Yorkers so royally that the two visitors were loath to leave them; Mr. Elra C. Palmer of Baltimore, Md., sacrificed ¾ of a day guiding them to eight interesting localities around his city. These are but some instances of the many courtesies extended them so that their trip was a most successful one.

AN IMPORTANT CORRECTION

In the May 1937 issue of **Rocks and Minerals,** in the Editor's article "Minerals of the Strickland Quarry", rhodonite was mentioned as having been found there. The reference was taken from a report of Prof. W. G. Foye which was printed in the Oct. 1919 issue of **The American Mineralogist.**

In the June 1920 issue of **The American Mineralogist,** p. 120, is a notice stating that the above occurrence was erroneous; that further investigation proved the mineral to be lithiophilite.

Will all readers possessing the May 1937 issue of **Rocks and Minerals** change "Rhodonite" to "Lithiophilite" in the last paragraph on page 139?

We regret that this erroneous report had to be repeated. Credit for the correction is due to a very good friend of **Rocks and Minerals.**

ZONAL GROWTH IN STRICKLAND MUSCOVITE

Apropos to the Strickland Quarry in Portland, Conn., I wish to call your attention to the zonal growth in some muscovite crystals from that locality. I collected two incomplete specimens bordered with lepidolite. He'd up against the light, both show parallel growth i.e. several lines following the sides of the crystals as in phlogopite. I haven't read about this and wonder if others have noticed the same in Strickland muscovite.

Gunner Bjareby,
Boston, Mass.

LANE TO HOLD SALE IN BOSTON

Boodle Lane, mineral dealer of Galena, Kansas, will hold a mineral sale in Boston Mass., around the end of October. He will bring with him about 500 very fine cabinet and museum specimens of the Tri-State district. We feel that every collector in and around Boston will want to see this very fine assortment of choice minerals. For further particulars relative to date and place of sale communicate direct with Boodle Lane, Box 331, Galena, Kansas.

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